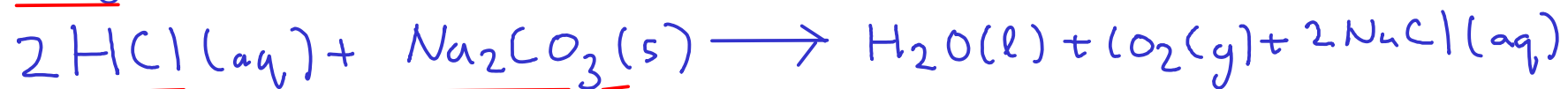


Example:

How many milliliters of 6.00M hydrochloric acid is needed to completely react with 25.0 g of sodium carbonate?



- 1 - Convert 25.0 g sodium carbonate to moles using formula weight.
- 2 - Convert moles sodium carbonate to moles hydrochloric acid using chemical equation.
- 3 - Convert moles hydrochloric acid to volume using concentration (6.00 mol/L)

$$\begin{array}{l} \text{Na}_2\text{CO}_3 : \text{Na} : 2 \times 22.99 \\ \quad \quad \quad \text{C} : 1 \times 12.01 \\ \quad \quad \quad \text{O} : 3 \times 16.00 \end{array}$$

$$\underline{105.99 \text{ g Na}_2\text{CO}_3 = \text{mol Na}_2\text{CO}_3}$$

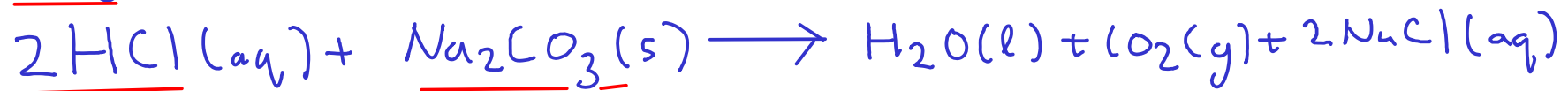
$$\textcircled{1} 25.0 \text{ g Na}_2\text{CO}_3 \times \frac{\text{mol Na}_2\text{CO}_3}{105.99 \text{ g Na}_2\text{CO}_3} = 0.2358713086 \text{ mol Na}_2\text{CO}_3$$

$$2 \text{ mol HCl} = \text{mol Na}_2\text{CO}_3$$

$$\textcircled{2} 0.2358713086 \text{ mol Na}_2\text{CO}_3 \times \frac{2 \text{ mol HCl}}{\text{mol Na}_2\text{CO}_3} = 0.4717426172 \text{ mol HCl}$$

145 Example:

How many milliliters of 6.00M hydrochloric acid is needed to completely react with 25.0 g of sodium carbonate?



- 1 - Convert 25.0 g sodium carbonate to moles using formula weight.
- 2 - Convert moles sodium carbonate to moles hydrochloric acid using chemical equation.
- 3 - Convert moles hydrochloric acid to volume using concentration (6.00 mol/L)

$$6.00 \text{ mol HCl} = \text{L} \quad \text{mL} = 10^{-3} \text{ L}$$

$$\textcircled{3} \quad 0.4717426172 \text{ mol HCl} \times \frac{\text{L}}{6.00 \text{ mol HCl}} \times \frac{\text{mL}}{10^{-3} \text{ L}} = 78.6 \text{ mL of } 6.00 \text{ M HCl}$$

You can solve the problem on one line if you want:

$$105.99 \text{ g Na}_2\text{CO}_3 = \text{mol Na}_2\text{CO}_3 \quad 2 \text{ mol HCl} = \text{mol Na}_2\text{CO}_3$$

$$6.00 \text{ mol HCl} = \text{L} \quad \text{mL} = 10^{-3} \text{ L}$$

$$25.0 \text{ g Na}_2\text{CO}_3 \times \underbrace{\frac{\text{mol Na}_2\text{CO}_3}{105.99 \text{ g Na}_2\text{CO}_3}}_{\textcircled{1}} \times \underbrace{\frac{2 \text{ mol HCl}}{\text{mol Na}_2\text{CO}_3}}_{\textcircled{2}} \times \underbrace{\frac{\text{L}}{6.00 \text{ mol HCl}} \times \frac{\text{mL}}{10^{-3} \text{ L}}}_{\textcircled{3}} = 78.6 \text{ mL}$$

EXAMPLE PROBLEM:



How many grams of sodium metal is required to completely react with 2545 grams of chlorine gas?

- 1 - Convert 2545 g of chlorine gas to moles. Use formula weight of chlorine gas.
- 2 - Convert moles chlorine gas to moles sodium using chemical equation.
- 3 - Convert moles sodium to mass sodium using formula weight of sodium.

$$\textcircled{1} \text{Cl}_2: 2 \times 35.45 = 70.90 \text{ g Cl}_2 = \text{mol Cl}_2 \quad | \quad \textcircled{2} 2 \text{ mol Na} = \text{mol Cl}_2$$

$$\textcircled{3} \text{Na}: 22.99 \text{ g Na} = \text{mol Na}$$

$$2545 \text{ g Cl}_2 \times \frac{\text{mol Cl}_2}{70.90 \text{ g Cl}_2} \times \frac{2 \text{ mol Na}}{\text{mol Cl}_2} \times \frac{22.99 \text{ g Na}}{\text{mol Na}} = \boxed{1650. \text{ g Na}}$$

$\textcircled{1}$
 $\textcircled{2}$
 $\textcircled{3}$